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(54) **OPTICAL ELEMENT AND PRODUCTION THEREOF**

(57)Abstract:
PROBLEM TO BE SOLVED: To manufacture a completely dried diffraction grating end optical element by a high speed processing by irradiating a polymeric material having a reflection film and processible with laser ablation with a beam of laser from a direction of the reflection film and making a diffraction grating form of the reflection film.
SOLUTION: A beam of laser oscillated from a laser device 1 is transmitted by being reflected by a total reflection mirror 2, etc., and is adjusted in the intensity and uniformed to be emitted onto a mask 4. An optical system is comprised of such a mechanism as an intensity distribution of the mask is fixed by a projection lens 5 and a processed piece 6 with a reflection film is fixed on a stage 7 adjustable in the direction of an optical axis, and a pattern is continuously formed by moving the stage 7, if necessary. And, a reflection film is added onto an ablative film. This film with the reflection film is irradiated with laser beam. A part of the irradiated laser beam transmits the reflection film and the polymeric material is irradiated the laser beam. Thus, this polymeric material is ablated and also the reflection film is removed, and a diffraction grating is formed.

CLAIMS

[Claim(s)]
[Claim 1]The optical element manufacture approach characterized by irradiating laser from the reflective film at the polymeric materials which have the reflective film at least in a part, and in which laser ablation processing is possible, and creating the shape of a diffraction lattice type of the reflective film with the laser ablation processing equipment which has the optical system in which the projection exposure of the mask of a grid configuration is possible.

[Claim 2]the optical element manufacture approach characterize by to irradiate laser from the reflective film , to move light or a substrate continuously to the ingredient which have the reflective film at least in a part , and in which laser ablation processing be possible , and to create the shape of a diffraction lattice type with the laser beam machining equipment which consist of means to which the location of arbitration may be make to carry out the parallel displacement of the means or the substrate which irradiate laser equipment and a laser beam in the location of arbitration .
[Claim 3]The optical element manufacture approach according to claim 1 or 2 characterized by using a reflective film ingredient with high laser which outputs the wavelength of an ultraviolet region and permeability in this wavelength.

[Claim 4]The optical element manufacture approach according to claim 1 to 3 characterized by processing it while the energy of the transmitted light by the reflective thin film adjusts the output of a laser beam with the laser equipment which can be adjusted in the field beyond a laser ablation threshold.
[Claim 5]The optical element manufacture approach according to claim 1 or 3 of having a scale-factor adjustment means and the parallel displacement means of a substrate.
[Claim 6]The optical element manufacture approach according to claim 1 or 2 of having a means to move the work material which carried out the solid configuration, and this ingredient in the direction of an optical axis.

[Claim 7]The optical element manufacture approach according to claim 1 or 2 characterized by using the ingredient which formed the macromolecule thin film layer in which laser ablation processing is possible in the middle of a glass substrate and the reflective film.
[Claim 8]The high polymer film which has the shape of a diffraction lattice type created by the means according to claim 1 or 2.
[Claim 9]The structure characterized by adding and constituting said high polymer film according to claim 8 which adds said high polymer film according to claim 8 with adhesives, and is constituted or, by which the adhesive layer or the glue line was prepared at least in the part.
[Claim 10]The structure characterized by adding and constituting the poly membrane which is equipped with the shape of a quirk which at least a part is the spherical surface and was created by the means according to claim 1 or 2, or has the shape of an above-mentioned quirk.
[Claim 11]The macromolecule structure which at least a part is a solid configuration and is characterized by being created by the means according to claim 6.
[Claim 12]The high polymer film according to claim 8 characterized by consisting of an ingredient which distributed the ingredient or extinction ingredient of a high absorption coefficient.
[Claim 13]Said poly membrane is the structure according to claim 10 characterized by consisting of an ingredient which it has [ingredient] the shape of a diffraction lattice type according to claim 8, and distributed the ingredient or extinction ingredient of a high absorption coefficient.

[Claim 14]The high polymer film according to claim 8 characterized by at least a part having the shape of a reflective film quirk on a transparent macromolecule.

[Claim 15]Said poly membrane is the structure according to claim 10 to which at least a part is characterized by having the shape of a reflective film quirk on a transparent macromolecule.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the optical element created by the manufacturing method and the above-mentioned manufacturing method of the various optical elements containing the diffraction grating for the spectrum by laser ablation, and monochrome-izing, the encoder scale for point-to-point control, etc.
[0002]
[Description of the Prior Art]Since the diffraction grating which is one of the optical elements has wavelength selection nature, it has been used as wavelength dispersion components, such as a spectroscope. Moreover, since reflection and the amount of transparency are spatially controllable, it is used as various optical elements. Moreover, especially the scale for encoders gains in importance in recent years for high precision positioning of a motor control stage, and use is progressing.
[0003]These diffraction gratings and a scale are mainly created until now by machining, photofabrication, the interference exposing method, and ion and an electron-beam-lithography method. It is the approach of creating the shape of a quirk of a diffraction grating in the substrate front face used as the base in machining, and forming the shape of a quirk continuously over the whole substrate surface. Photofabrication is the approach of pattern-izing the resist film applied to the substrate front face by mask exposure, and forming the shape of a quirk of a substrate by etching. The interference exposing method is the approach of pattern-izing the resist film by the 2 flux-of-light light interference exposing method, carrying out [etching etc. and], and forming the shape of a quirk. Ion and an electron beam straight-writing method are the approaches of forming the shape of a quirk by controlling a energy beam spatially and irradiating a substrate top.
[0004]Moreover, laser ablation processing is technique currently studied as a direct processing method which does not need a resist work piece, and attracts attention as the micro-processing method of the ingredient centering on a macromolecule, or a thin film forming method by the quality of debris. As a diffraction-grating manufacturing method using ablation, there are some which were indicated in JP,7-027910,A or a JP,8-1847078,A official report. By the former technique, a laser beam is irradiated at a direct substrate and the shape of a quirk is formed according to an ablation operation of a substrate. In the latter, it is the approach of forming a grid by making the fragmentation by laser ablation collide with a substrate through a mask. The above-mentioned diffraction grating is usually created by the glass substrate etc., and the shape of a quirk is formed by the metal membrane on flat-surface glass, the resist film, the resin film, etc.
[0005]
[Problem(s) to be Solved by the Invention]However, it was difficult to create the shape of a quirk of a minute diffraction grating with repeatability often [precision] and sufficient in the above-mentioned machining. By the approach by photofabrication, many processes, such as resist spreading, desiccation, development, and etching, were needed, quirk-like control was difficult and the cross-section configuration had a limit.

[0006]Expertise, such as effect removal, alignment, etc. of vibration of processing equipment, is required of the interference exposing method, a work material is also restricted to a giant-molecule nature photoresist, 2P resin, etc., and selection width of face is narrow. Moreover, also in this case, control of a processing configuration was difficult and there was a problem which is easy to cause form status change-ization.
[0007]Furthermore, by photofabrication and the interference exposing method, wet processes, such as resist spreading, were included, there was a problem of which impurity mixing and a washing process are required, and when a substrate ingredient was not a flat surface, correspondence was not completed.
[0008]It was difficult for there to be a problem that processing cost is high, from that the manufacturing method by the electron and the ion beam takes a large-scale vacuum system, the point that an electron and the source of an ion beam are expensive, etc., and for working speed to also create a long scale late.

[0009]In the manufacturing method by laser ablation, the substrate ingredient is processed directly. In laser ablation, big energy is required for removal processing of a metallic material, and control of a configuration is difficult. Glass and laser energy also with the big case of a ceramic ingredient are required, and contraction projection processing is difficult productivity highly. Moreover, this is the processing method for a single ingredient, and had the problem on which control of a reflection factor and quirk-like control are governed by the property of a single ingredient. Moreover, in ablation, control of the processing depth per one exposure of a laser beam was difficult, and creation of the grid of the same configuration was difficult.
[0010]Moreover, the shape of a quirk to the field top which these manufacturing methods create optical elements, such as a diffraction grating and a scale, on planar structure ingredients, such as a glass substrate with usually high flatness, and has the spherical surface was difficult. Moreover, when adding a diffraction grating to other ingredients, addition of a up to [the field to rotate or the ingredient which carries out elongation deformation] was difficult.
[0011]Moreover, in order to control a signal by reflection, the ingredient which carries out light absorption needed to be added to the rear face of a glass substrate, and in order that reflection might cut with a front face and the rear face in this case, there was a problem influenced of a substrate ingredient. Moreover, since the selectivity of a substrate ingredient was low, the expensive substrate ingredient needed to be used, and the limit of the charge of a binder for pasting up the addition ingredient and component to a component also had many problems.
[0012]It was made in order that this invention might solve the technical problem and fault of the above conventional techniques, and it aims at offering the optical element which has the shape of a quirk created by the high-speed processing manufacture approach and the above-mentioned manufacturing method of a diffraction grating or an optical element which were made perfect dry.

[0013]
[Means for Solving the Problem]The optical element manufacture approach which starts claim 1 of this invention in order to realize said technical problem is characterized by to irradiate laser from the reflective film at the polymeric materials which have the reflective film at least in a part and in which laser ablation processing is possible, and to create the shape of a diffraction lattice type of the reflective film with the laser ablation processing equipment which has the optical system in which the projection exposure of the mask of a grid configuration is possible.
[0014]the optical element manufacture approach concerning claim 2 of this invention characterize by to irradiate laser from a reflective film , to move light or a substrate continuously to the ingredient which have a reflective film at least in a part and in which laser ablation processing be possible , and to

create the shape of a diffraction lattice type with the laser beam machining equipment which consist of means to which the location of arbitration may make carry out the parallel displacement of the means or the substrate which irradiate laser equipment and a laser beam in the location of arbitration .

[0015]The optical element manufacture approach concerning claim 3 of this invention is characterized by using a reflective film ingredient with high laser which outputs the wavelength of an ultraviolet region in the optical element manufacture approach according to claim 1 or 2 and permeability in this wavelength.

[0016]the optical element manufacture approach concerning claim 4 of this invention -- claims 1-3 -- it is characterized by processing it, while the laser equipment which the energy of the transmitted light by the reflective thin film can adjust in the field beyond a laser ablation threshold in the optical element manufacture approach of a publication adjusts the output of a laser beam to either.

[0017]The optical element manufacture approach concerning claim 5 of this invention is characterized by having a scale-factor adjustment means and the parallel displacement means of a substrate in the optical element manufacture approach according to claim 1 or 3.

[0018]The optical element manufacture approach concerning claim 6 of this invention is characterized by having a means to move the work material which carried out the solid configuration in the optical element manufacture approach according to claim 1 or 2, and this ingredient in the direction of an optical axis.

[0019]The optical element manufacture approach concerning claim 7 of this invention is characterized by using the ingredient which formed the macromolecule thin film layer in which laser ablation processing is possible in the middle of a glass substrate and the reflective film in the optical element manufacture approach according to claim 1 or 2.

[0020]The high polymer film concerning claim 8 of this invention is characterized by having the shape of a diffraction lattice type created by the means according to claim 1 or 2.

[0021]The structure which added the high polymer film concerning claim 9 of this invention is characterized by adding and constituting said high polymer film according to claim 8 which adds said high polymer film according to claim 8 with adhesives, and is constituted or by which the adhesive layer or the glue line was prepared at least in the part.

[0022]At least a part is the spherical surface and the structure concerning claim 10 of this invention is characterized by adding and constituting the poly membrane which is equipped with the shape of a quirk created by the means according to claim 1 or 2, or has the shape of an above-mentioned quirk.

[0023]At least a part is a solid configuration and the macromolecule structure concerning claim 11 of this invention is characterized by being created by the means according to claim 6.

[0024]The high polymer film concerning claim 12 of this invention is a high polymer film according to claim 8, and is characterized by consisting of an ingredient which distributed the ingredient or extinction ingredient of a high absorption coefficient. Moreover, the structure concerning claim 13 of this invention is characterized by said poly membrane consisting of an ingredient which it has [ingredient] the shape of a diffraction lattice type according to claim 8, and distributed the ingredient or extinction ingredient of a high absorption coefficient in the structure according to claim 10.

[0025]The high polymer film concerning claim 14 of this invention is a high polymer film according to claim 8, and is characterized by at least a part having the shape of a reflective film quirk on a transparent macromolecule. Moreover, the structure concerning claim 15 of this invention is the structure according to claim 10, and said poly membrane is characterized by at least a part having the shape of a reflective film quirk on a transparent macromolecule.

[0026]By the configuration concerning above this inventions, the irradiated laser beam penetrates the reflective film on a work material, and it reaches to polymeric materials, and according to the ablation operation by this laser beam, the cleavage in the molecular level of polymeric materials sets, and a laser radiation part disperses outside. Since the matter which disperses outside at this time also disperses the reflective film of that upper part in coincidence, processing of the exposure section whole region is performed.
[0027]Moreover, continuous configuration processing is made by carrying out the parallel displacement of the workpiece.
[0028]When scanning a laser beam furthermore, processing of the optical element of a large area and a long picture is made by processing of the configuration of arbitration being made without a mask in order to carry out direct writing, and carrying out the parallel displacement of the workpiece to coincidence.

[0029]Moreover, polymeric materials have absorption strong against an ultraviolet region, and since there are many ingredients in which ablation processing with ultraviolet laser is possible, efficient processing is made by using the laser of an ultraviolet region. Moreover, the configuration formation from which a flute width differs on the same component is made by using a means to adjust laser reinforcement.
[0030]Moreover, in contraction projection processing by mask projection, selection of a processing scale factor is made by moving any two, a mask location, a projection lens, and the processing location, to coincidence, and the shape of a quirk from which a scale factor differs by this is formed.

[0031]Moreover, processing to the ingredient which carried out the solid configuration is made by doubling the focus of a workpiece with a laser radiation focal location, and reflex-like generation of a up to [the structure which carried out the spherical-surface top and the stage configuration] is made.

[0032]Furthermore, a laser ablation layer is prepared in the middle, and processing of glass substrates with a reflective thin film, such as metallic reflection film, is made by removing it by laser radiation. Moreover, when the ablation energy threshold of glass is sharply larger than a macromolecule, processing which does not do damage to a glass side by accommodation of processing energy is made.
[0033]Next, a form status change form is easy for the high polymer film which has the optical function manufactured according to these manufacturing methods, and selection of cheap and a function becomes easy.
[0034]By the film which added the glue line as these polymeric materials being chosen, addition processing is immediately made after processing to other ingredients.
[0035]Moreover, the optical functional addition to the spherical surface is made by the optical functional addition into an ingredient and the addition of the above-mentioned film with a binder which have the spherical surface.

[0036]Moreover, processing to the structure which carried out the solid configuration is attained, and the structure by which the reflective film was controlled in three dimensions is created.
[0037]Moreover, by raising the absorption coefficient of polymeric materials, it approaches, the reflective film and an absorption band can be generated, and a gradual change of a reflection factor and the thin film optical element of a multi-gradation property are realized.
[0038]Moreover, a transparency mold optical element is realized by using a transparent macromolecule conversely.
[0039]
[Embodiment of the Invention]By the manufacture approach by this invention, it consists of a process which contraction-projects, or scans a laser beam and irradiates a space selection target at a substrate, a means to move a substrate

to a three dimension, and polymeric materials which have the reflective film and in which ablation is possible. Furthermore, in order to raise the working characteristic of a macromolecule, it is desirable to consist of charges of a reflector with the high permeability in the wavelength of ultraviolet laser and this laser beam.

[0040]When a contraction projection scale factor adjusts a processing slot pitch, it consists of a mask, a lens, and any two parallel displacement means of the processing substrate location. Especially a work material forms the thin film of the polymeric materials in which ablation is possible between a substrate and the reflective film, when it consists of polymeric materials which added the reflective thin film and forms the reflective film especially on a glass substrate.

[0041]Moreover, the high polymer film in which the optical element by this invention has the shape of a quirk of the reflective film and in which a form status change form is possible, The structure which has the spherical surface, the macromolecule structure which carried out the solid configuration, the structure which added the above-mentioned film, or [********] -- from -- it is constituted and, as for polymeric materials, it is desirable to consist of a transparent material, a light absorption ingredient, or a charge of light absorption ingredient add-in material, and when pasting up a component on the structure, the ingredient with which the charge of a binder was added beforehand is desirable.

[0042]The gestalt of operation of this invention is explained below.

(The 1st operation gestalt) The 1st operation gestalt of this invention is shown in drawing 1. Being transmitted in total reflection mirror 2 grade, by the shaping optical system 3, it is reinforcement-adjusted, and is equalized, and the laser beam oscillated from laser equipment 1 in this drawing is irradiated by the mask 4. With the projection lens 5, the intensity distribution of a mask are projected on the workpiece 6 with the reflective film. It is fixed on the stage 7 which can be adjusted in the direction of an optical axis, and if the workpiece 6 with the reflective film has the need, it will consist of a device which moves on a stage 7 and creates a pattern continuously.

[0043]The mimetic diagram of the manufacturing method of the optical element by this invention is shown in drawing 2. About 500-1000A of reflective film M2 is added on the film M1 in which ablation is possible. Reflective film N 2 can create the poly membrane containing the approach of adding metal membranes, such as Cr and aluminum, by vacuum evaporationo or the spatter, coloring matter, etc. on a spin coat etc. A laser beam M3 is irradiated at this film M1 with the reflective film. A part of irradiated laser beam M3 penetrates the reflective film M2, and it is irradiated by polymeric materials M1. The reflective film M2 is removed with the ablation of this giant molecule, and a diffraction grating M4 is formed.

[0044](The 2nd operation gestalt) The 2nd operation gestalt of this invention is shown in drawing 3. It is transmitted through a total reflection mirror 13 or orifice 14 grade, and is condensed with a condenser lens 15, and the laser beam 12 oscillated from laser equipment 1 is irradiated by the sample. A laser beam is scanned by a galvanomirror 16 and the migration stage 17 on a work material 18. A work material 18 consists of a configuration of said drawing 2, and is processed by the same principle. A laser beam can adjust changing-laser reinforcement processing width of face, and the same operation is possible for it even if it forms beam attenuator in equipment.

[0045](The 3rd operation gestalt) The 3rd operation gestalt of this invention is shown in drawing 4. Being transmitted in total reflection mirror 2 grade, by the shaping optical system 3, it is reinforcement-adjusted, and is equalized, and the laser beam oscillated from laser equipment 1 is irradiated by the mask 4. A mask is installed on the migration stage 25 and is movable to the direction of an optical axis. Moreover, it has the device in which a mask is rotated by the case, and the device in which masks are exchanged. The image of a mask is irradiated by work material 8 front face fixed on the migration stage 7 through the projection

lens 5. This mask migration stage 25 and the migration stage 7 are controlled by the computer 10 through the stage controller 9. Migration, the number of laser radiation, and laser radiation reinforcement of a stage are controlled by the computer to coincidence. Configuration processing from which a scale factor differs is attained from one mask by this, and various configuration processings are attained by performing mask exchange and laser adjustment on the strength to coincidence.

[0046](The 4th operation gestalt) The 4th operation gestalt of the glass substrate top diffraction-grating creating method is shown in drawing 5. A poly membrane N2 is added on a glass substrate N1. If a poly membrane N2 sets to about 0.1 micrometers or less, it can exfoliate the reflective film N3 and a poly membrane N2 in coincidence in one laser beam exposure of low energy comparatively. moreover, the thing for which laser reinforcement is irradiated below at the laser ablation threshold of glass -- the glass front face N1 -- effect ****** -- creation of a highly precise reflective film configuration [be / nothings] can be performed. An ingredient can use not only a giant-molecule nature resist but the photo-curing and heat-curing mold resin, and the various giant molecules which are used for exposure.

[0047](The 5th operation gestalt) The manufacturing method of an optical element and optical element which are the 5th operation gestalt by this invention are shown in drawing 6. The reflective film P2, such as Cr and aluminum, is added on the macromolecule optical material P1 which has the spherical surfaces, such as an optical lens. A laser beam P3 is alternatively irradiated from on the reflective film of this ingredient. If the shape of a quirk of the reflective film P2 generates by this and light is irradiated at this component, a part will be reflected and a part will penetrate. The reflected light diffuses at this time and the transmitted light is condensed. Thus, the processed optical element P4 has an optical function.

[0048](The 6th operation gestalt) The optical element which has the spherical surface by spherical-surface processing which is the 6th operation gestalt by this invention in drawing 7 is shown. On the structure R1 which the shape of a cylinder rotates, the macromolecule thin film R2 in which ablation is possible is added, and the reflective film R3 is added further. A laser beam R4 is irradiated partially at this, and a reflective film pattern is formed according to the above-mentioned ablation operation. By carrying out the sequential exposure of the laser beam R4, rotating this body of revolution R1, a reflective film pattern is formed in body-of-revolution R1 front face, and the surface scale R5 is created. Since this scale is formed in a front face, it becomes available to surface position control and surface speed control. This creates a scale and adding it to body of revolution can also attain.

[0049](The 7th operation gestalt) The manufactured optical element is indicated to be an example of reflective pattern manufacture to the spacial configuration object which is the 7th operation gestalt by this invention to drawing 8. The polymeric materials in which ablation processing is possible are processed in three dimensions, and it considers as the spacial configuration object S1. Machining, the Mitsuzo form, ablation processing, etc. can be used for solid processing. The reflective film S2 is added to this ingredient by the spatter, vacuum evaporationo, etc., and a laser beam S3 is irradiated at a space selection target. Only the flat-surface section of drawing 8 is processed according to the above-mentioned laser ablation operation. Thereby, light penetrates the flat-surface section and a slant face serves as optical element S4 to reflect. If the signal light S5 is irradiated at this component, it will be reflected partially and light will function as a light reflex component as shown in drawing.

[0050](The 8th operation gestalt) The optical element which includes in drawing 9 the charge of an absorber which is the 8th operation gestalt by this invention is shown. The poly membrane T1 which controlled the absorption coefficient is taken as the structure where put on a multistage story, or control variance, and a reflection factor changes with thickness. The reflective film T2 is added on this

poly membrane T1, and laser beam T3 is irradiated there. Laser beam T3 controls reinforcement, changes the processing depth by changing an exposure, and is taken as structure T four shown in drawing 9. If light is irradiated at such structure T four, as shown in drawing 10, signal strength will change with locations. The function as an optical element which generates a gradual signal by this is achieved.

[0051](The 9th operation gestalt) One example of the optical element using the transparence macromolecule which is the 9th operation gestalt by this invention is shown in drawing 11. Patterning is carried out to the configuration which shows the reflective film V2 on the macromolecule thin film V1 in drawing (A) by the above-mentioned technique. It is shown in (B) and (C) still more nearly similarly, and configuration processing is carried out and an optical element V3 is created. Since these are transparent and it is also possible to make it very thin, pattern processing of a complicated configuration in piles as shown in drawing is attained in these. In this case, (A), (B), and (C) are possible also for considering as the same configuration, and since it is transparent, signal processing of a transparency mold of them also becomes possible.

[0052]

[Effect of the Invention]As explained in full detail above, according to this invention, a part of irradiated laser beam reaches to polymeric materials by using the reflective film on a work material as a thin film. According to the ablation operation by this laser beam, the cleavage in the molecular level of polymeric materials sets, and a laser radiation part disperses outside. Since the matter which disperses outside at this time also disperses the reflective film of that upper part in coincidence, processing of the exposure section whole region is performed.

[0053]By making reflective film thickness thin here, processing of the reflective film is possible at a laser beam child piece, and since laser radiation time amount can be shortened at several or less nanoseconds, very high-speed processing is attained. Moreover, since reflection is controlled by removing the reflective film, it is not necessary to control the processing configuration of the depth direction correctly, and many ingredients can be used as the reflective film and a substrate ingredient.

[0054]In contraction projection processing, the configuration of a mask is reduced and the location of a request of a substrate irradiates. In such contraction projection, since it can carry out by putting the configuration of a large area in block, productivity becomes high very much.

[0055]Moreover, by carrying out the parallel displacement of the workpiece, it is possible to carry out configuration processing continuously, and creation of a long scale etc. can be performed easily. Moreover, mask shape can be chosen, masks are exchanged and not only the shape of a quirk but the shape of a various reflex can be created.

[0056]When scanning a laser beam furthermore, since direct writing is carried out, it is possible to process the configuration of arbitration without a mask, and since a laser beam is condensed and used, also when a laser output is low, it is available, and can be processed into a high speed by using repeat laser, a galvanomirror, etc. Moreover, it becomes processible [the optical element of a large area and a long picture] by carrying out the parallel displacement of the workpiece to coincidence.

[0057]Usually, polymeric materials have absorption strong against an ultraviolet region, and there are many ingredients in which ablation processing with ultraviolet laser is possible. For the reason, efficient processing is attained by using the laser of an ultraviolet region. Under the present circumstances, since the reflection property in a visible region is used from infrared rays, when using ultraviolet laser, it is desirable [the charge of a reflector] to use an ingredient with high permeability in that wavelength region.

[0058]Moreover, film processing width of face changes with laser energy intensity

in thin film processing by assistance of such ablation. Therefore, by using a means to adjust laser reinforcement, formation becomes possible easily about the configuration from which a flute width differs on the same component.

[0059]Moreover, in contraction projection processing by mask projection, it is possible to choose a processing scale factor as arbitration by moving any two, a mask location, a projection lens, and the processing location, to coincidence, and formation of it is easily attained in the shape of a quirk from which a scale factor differs by this.

[0060]Moreover, it becomes processible to the ingredient which carried out the solid configuration by doubling the focus of a workpiece with a laser radiation focal location, and reflex-like generation of a up to [the structure which carried out the spherical-surface top and the stage configuration] also becomes possible.

[0061]In metal thin film processing on a glass substrate, generally by laser ablation, processing becomes possible [processing glass substrates with a reflective thin film, such as difficult metallic reflection film, into a high speed by low energy] by preparing a laser ablation layer in the middle and removing it. Moreover, the cross-section configuration of this removed film turns into a good configuration which is not acquired in thermoforming, such as laser trimming.

[0062]Moreover, the ablation energy threshold of glass is sharply larger than a macromolecule in many cases, and becomes processible [which does not do damage to a glass side] by processing it with this energy. There is also a cleaning effect which removes the organic substance which adhered to coincidence in the glass side at this time.

[0063]Next, it is cheap, and the high polymer film which has the optical function manufactured according to these manufacturing methods has the description that brittleness is low, and selection of a function is [the selectivity of an ingredient is high and] a form status change form is possible and possible for it.

[0064]By choosing the film which added the glue line as these polymeric materials, it is possible to add to other ingredients immediately after processing, and the optical function to a structure agent can be added. Especially the adhesives of a macromolecule have wide selection width of face, and are easy to choose bond strength, a thickness heat characteristic, etc.

[0065]Moreover, the optical functional addition to the difficult spherical surface becomes easy by the optical functional addition into an ingredient and the addition of the above-mentioned film with a binder which have the spherical surface. Thereby, the mask to a lens top, encoder ability creation of a up to [an optical branching component and the spherical surface], etc. are attained.

[0066]Moreover, processing to the structure which carried out the solid configuration is also possible, and the structure by which the reflective film was controlled in three dimensions can be created. Since such the structure can control an optical function spatially, it becomes possible [adding an optical function to some of reflective branching components, micro machines and sensors].

[0067]Moreover, the reflective film and an absorption band can approach and generate by raising the absorption coefficient of polymeric materials, a reflection factor is changed gradually or creation of the thin film optical element in which the signal of many gradation is formed is attained. Moreover, by making light absorb in a macromolecule layer, it is N/A of the component of a reflective mold. It can raise.

[0068]Moreover, the use as the same transparency mold optical element as glass is attained by using a transparent macromolecule conversely, and it becomes possible in these components to perform superposition and various signal formation.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a schematic diagram in the first operation gestalt of the optical element manufacturing installation concerning this invention.

[Drawing 2]It is the schematic diagram of the optical element manufacturing method in the 1st operation gestalt of this invention.
[Drawing 3]It is the schematic diagram of the optical element manufacturing installation in the 2nd operation gestalt of this invention.
[Drawing 4]It is the schematic diagram of the optical element manufacturing installation in the 3rd operation gestalt of this invention.
[Drawing 5]It is the schematic diagram of the diffraction-grating manufacturing method in the 4th operation gestalt of this invention.
[Drawing 6]It is the schematic diagram of the optical element manufacturing method in the 5th operation gestalt of this invention, and an optical element.

[Drawing 7]It is the schematic diagram of the optical element manufacturing method in the 6th operation gestalt of this invention, and an optical element.

[Drawing 8]It is the schematic diagram of the optical element manufacturing method in the 7th operation gestalt of this invention, and an optical element.

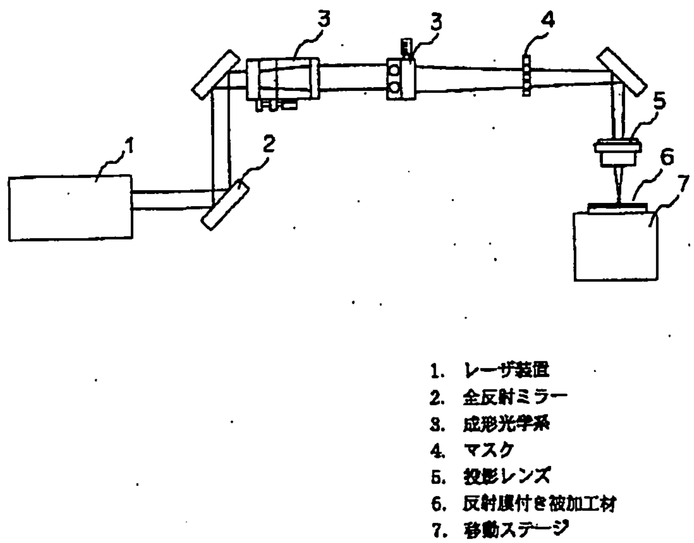
[Drawing 9]It is the schematic diagram of the optical element manufacturing method in the 8th operation gestalt of this invention, and an optical element.

[Drawing 10]It is drawing showing the example of a signal from the optical element in the 8th operation gestalt of this invention.
[Drawing 11]It is the schematic diagram of the optical element manufacturing method in the 9th operation gestalt of this invention, and an optical element.

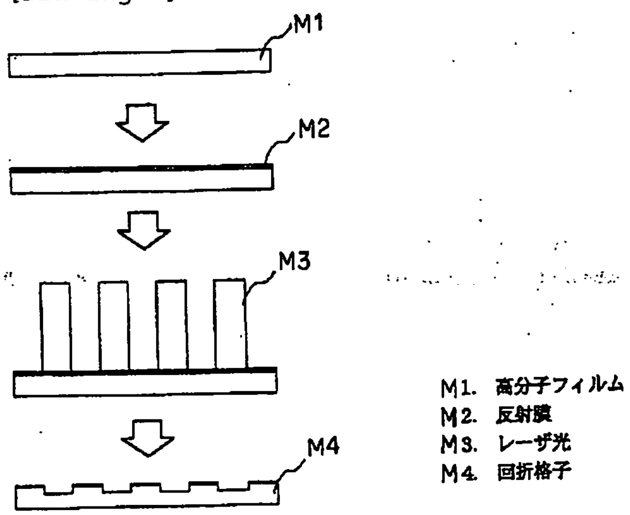
[Description of Notations]
1 Laser Equipment
2 Total Reflection Mirror
3 Shaping Optical System
4 Mask
5 Projection Lens
6 Work Material with Reflective Film
7 Stage

DRAWINGS

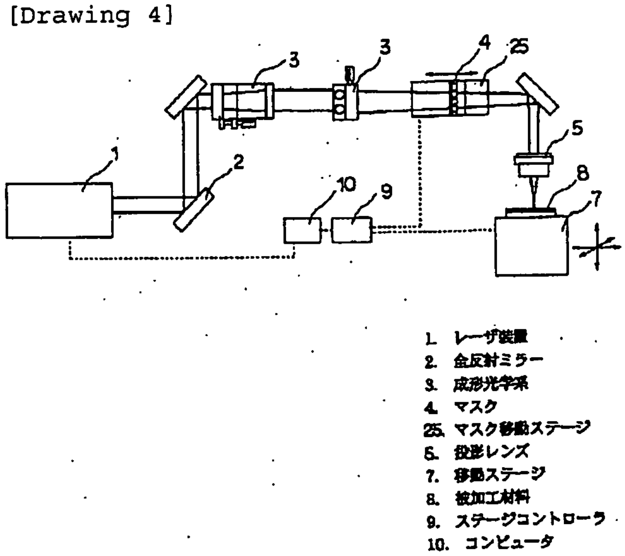
[Drawing 1]



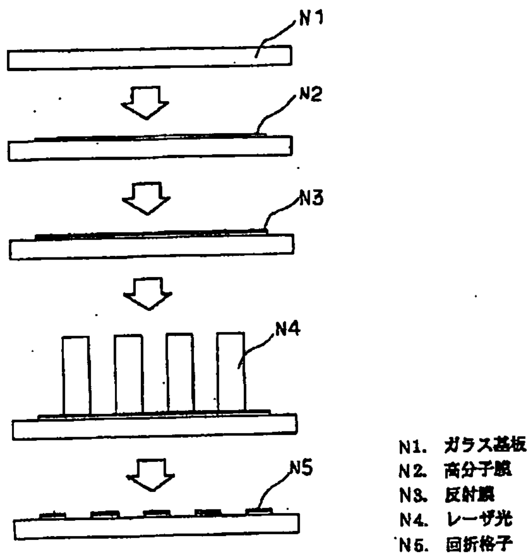
[Drawing 2]



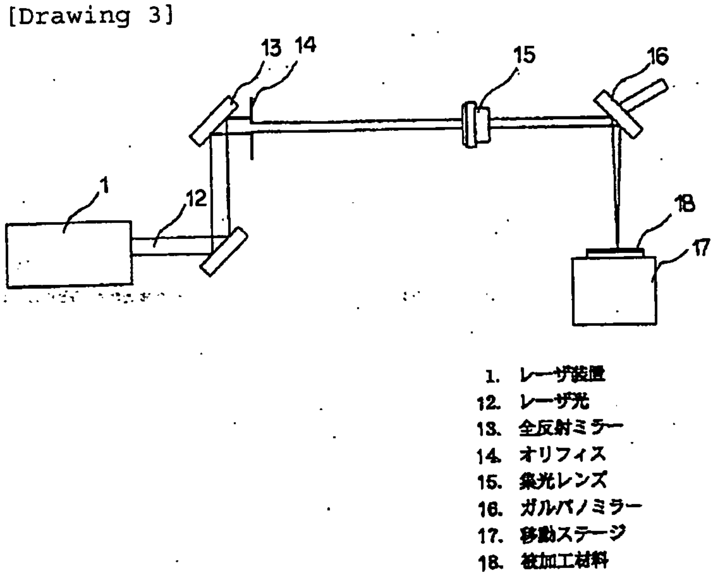
[Drawing 4]



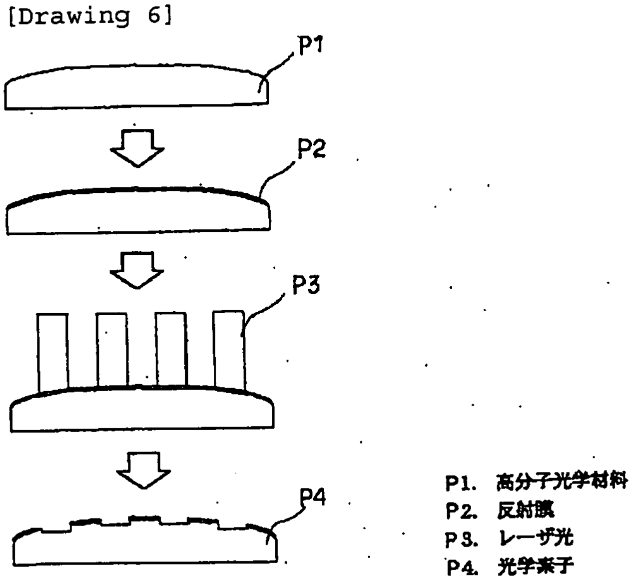
[Drawing 5]



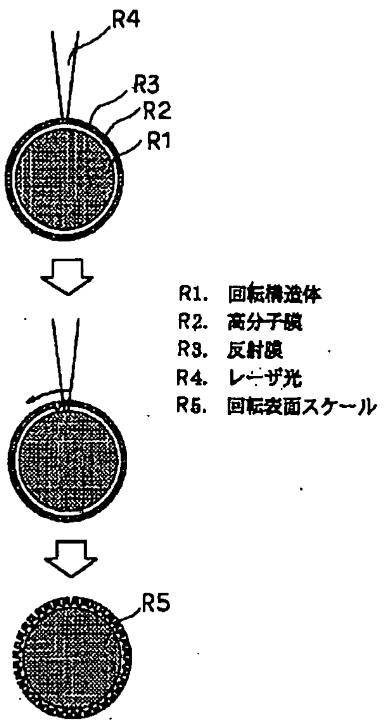
[Drawing 3]



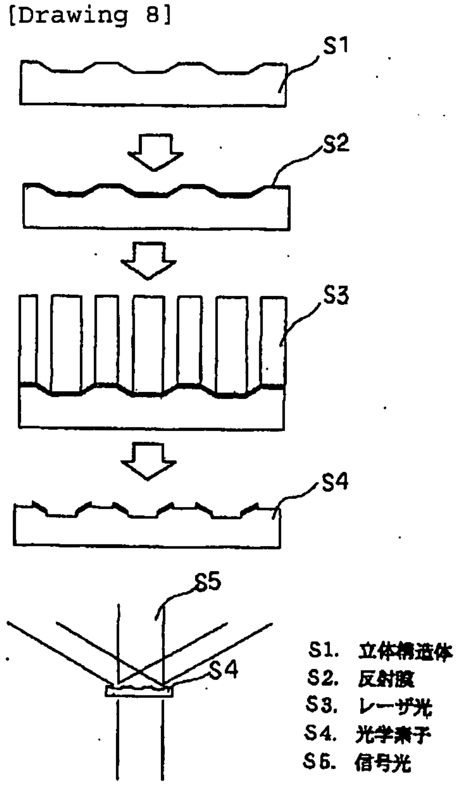
[Drawing 6]



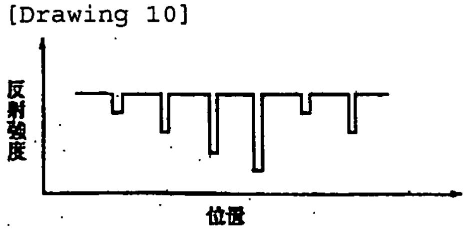
[Drawing 7]



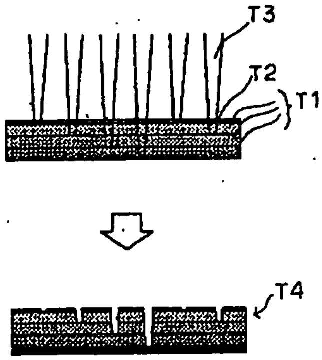
[Drawing 8]



[Drawing 10]

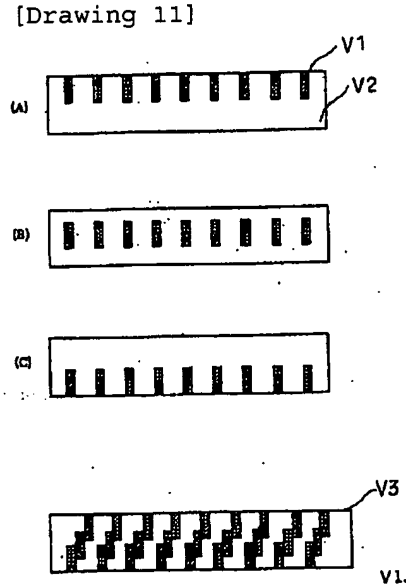


[Drawing 9]



T1. 高分子膜
T2. 反射膜
T3. レーザ光
T4. 構造体

[Drawing 11]



V1. 透明高分子膜
V2. 反射膜
V3. 構造体